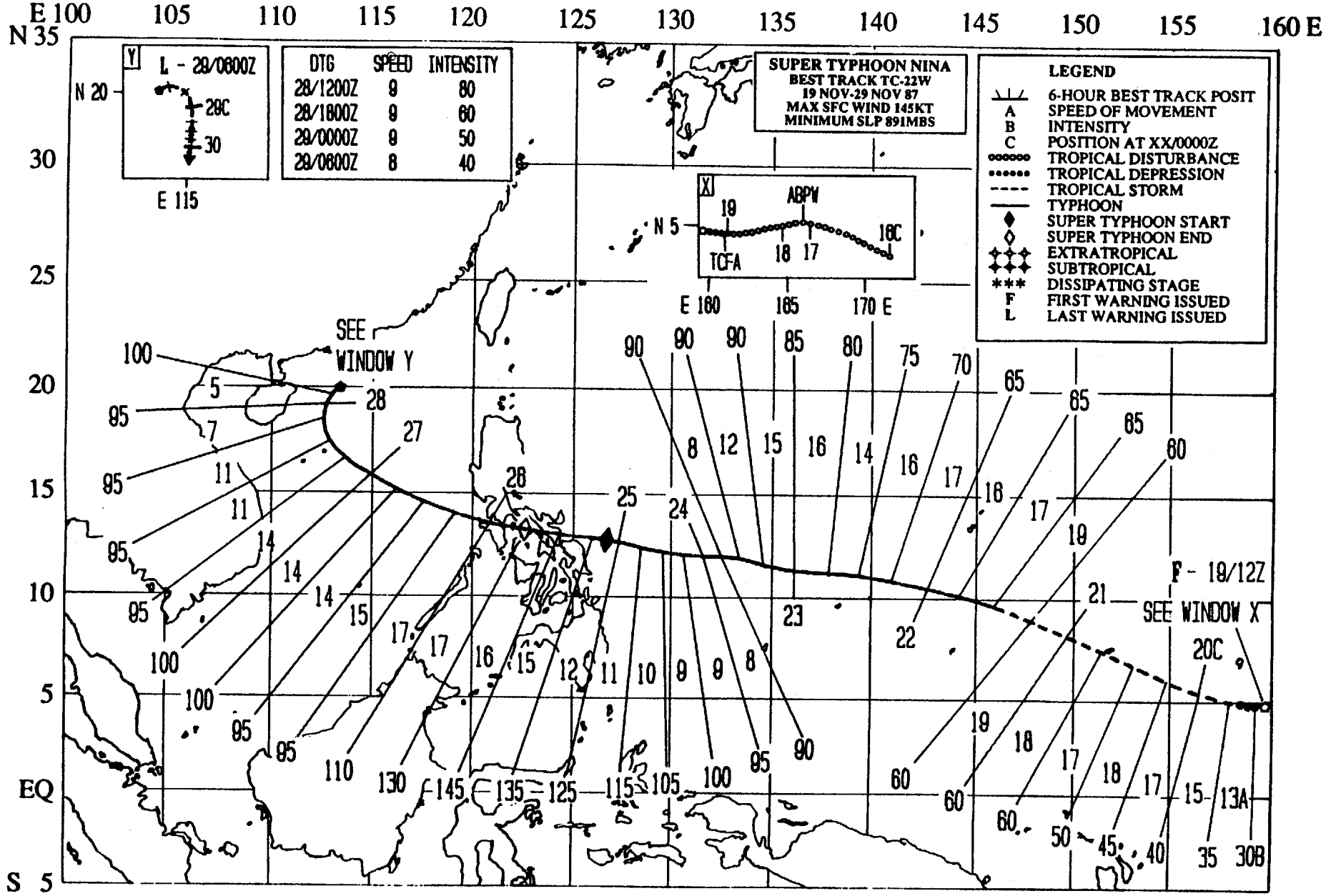
SUPER TYPHOON NINA
BEST TRACK TC-22W
19 NOV-29 NOV 87
MAX SFC WIND 145KT
MINIMUM SLP 891MBS
LEGEND
6-HOUR BEST TRACK POSIT
A SPEED OF MOVEMENT
B INTENSITY
C POSITION AT XX/0000Z
TROPICAL DISTURBANCE
TROPICAL DEPRESSION
TROPICAL STORM
TYPHOON
SUPER TYPHOON START
SUPER TYPHOON END
EXTRATROPICAL
SUBTROPICAL
DISSIPATING STAGE
F FIRST WARNING ISSUED
L LAST WARNING ISSUED
DTG SPEED INTENSITY
28/1200Z 9 80
28/1800Z 9 60
29/0000Z 9 50
29/0600Z 8 40
L - 29/0600Z
28C
30
TCFA
ABPW
18C
SEE WINDOW Y
SEE WINDOW X
F - 19/12Z
20C
13A
30B
E 100
105
110
115
120
125
130
135
140
145
150
155
160 E
N 35
30
25
20
15
10
5
EQ
S 5
N 20
N 5
E 115
E 160
165
170 E

SUPER TYPHOON NINA (22W)

Super Typhoon Nina was the most intense and most destructive tropical cyclone to develop in the western North Pacific in 1987. During its track toward the west, it devastated the Truk Atoll in the eastern Caroline Islands, decimated the north central Philippine Islands and then executed a final dramatic loop in the South China Sea south of Hong Kong. Nina was the second of three significant tropical cyclones to develop during November.

Nina developed in low latitudes just west of the dateline. At 150000Z, satellite intensity analysis (Dvorak, 1984) estimated a cloud system center had maximum sustained surface winds of 25 kt (13 m/sec). For two days this disturbance showed marked diurnal fluctuations in convection. It was first mentioned on the 170600Z Significant Tropical Weather Advisory (ABPW PGTW) as a system with fair potential to develop into a significant tropical cyclone. The system displayed good upper-level outflow and increasing convection over a broad area.

A Tropical Cyclone Formation Alert was issued at 190100Z as deep convection consolidated in the center of the tropical disturbance. Synoptically, the system appeared to be well-established in the low levels up to 400 mb (Figure 3-22-1) with 25 to 30 kt (13 to 15 m/sec) easterlies aloft. With speed and directional divergence aloft, Nina continued its rapid organization. At 191200Z, the first warning was issued on Tropical Depression 22W. By that time, Nina had formed a curved band of convection. Satellite imagery (Figure 3-22-2) suggested unrestricted upper-level outflow over the system; however, the upper-level rawinsonde reports showed that the anticyclonic circulation (at 200 mb) was displaced to the east of the center of cirrus outflow (Figure 3-22-3).

At the time of the first warning, working plots of satellite fix positions indicated Nina was slowing down its west-northwestward movement. (To the contrary, post-analysis revealed that Nina did not slow down while intensifying but actually accelerated slightly.

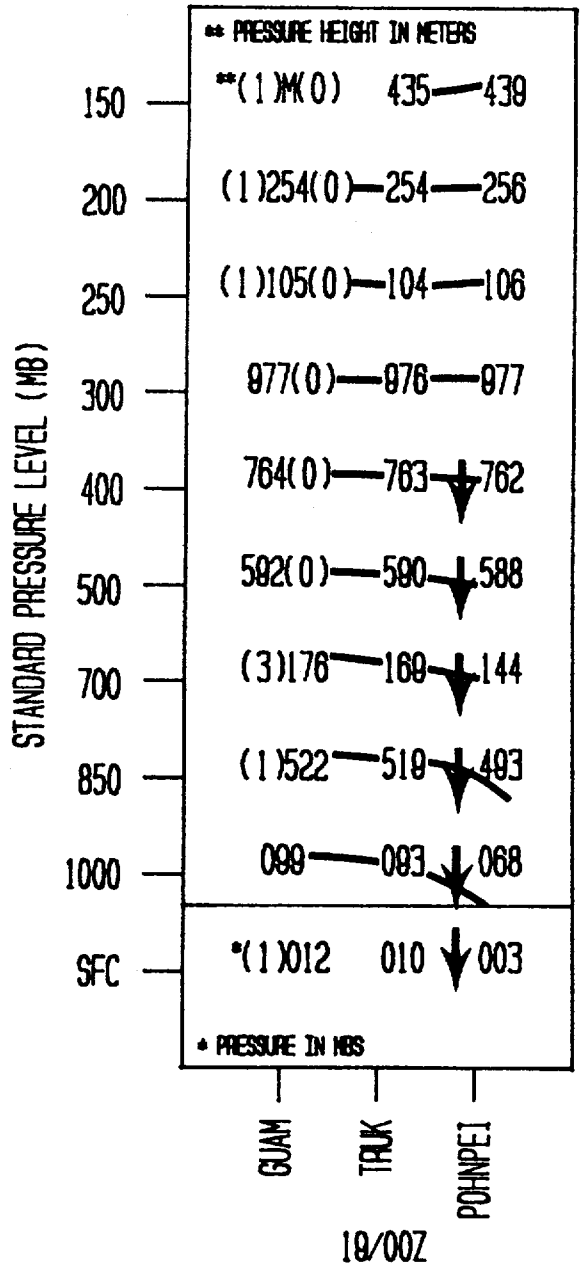

Figure 3-22-1. Heights of the standard pressure levels and surface pressure at Pohnpei (WMO 91348), Truk (WMO 91334) and Guam (WMO 91217) at 190000Z. At this time, Nina was 230 nm (426 km) southeast of the island of Pohnpei. In comparison with Truk and Guam, the lower heights at Pohnpei (WMO 91348) at the 400 mb level and below are due to the approaching tropical cyclone.

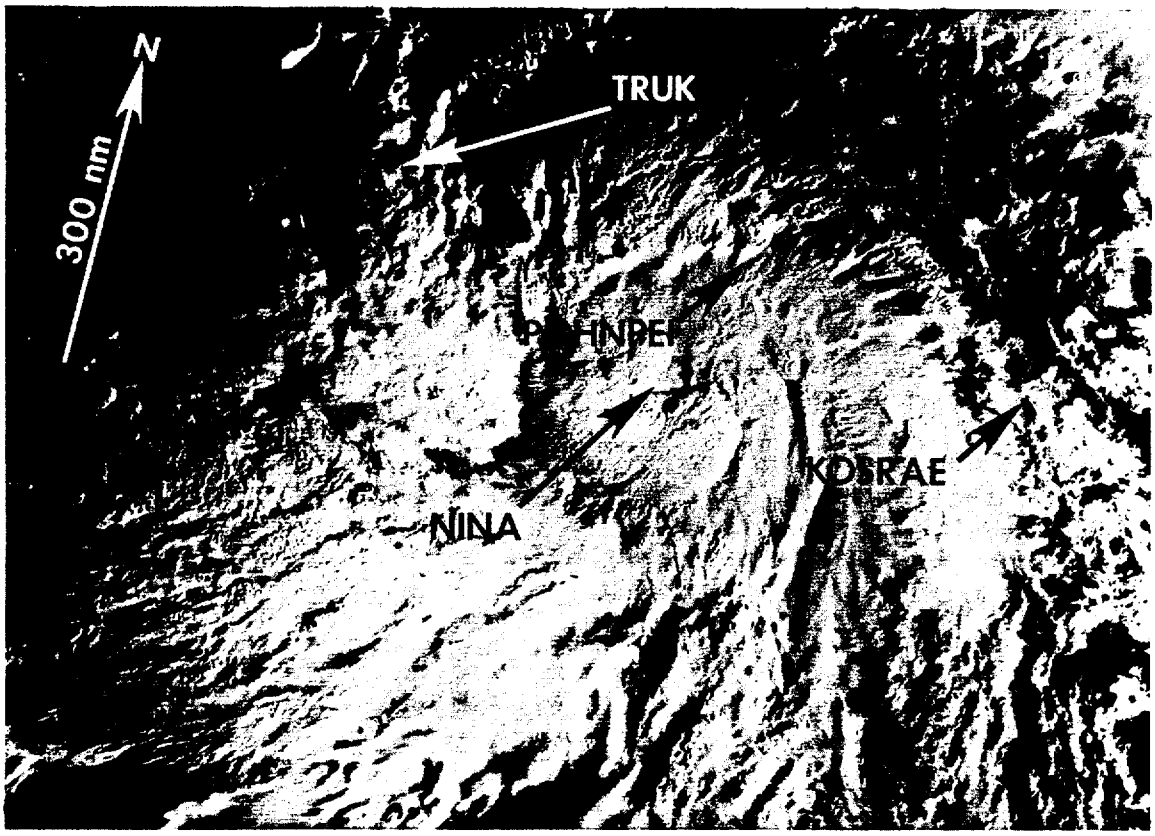

Figure 3-22-2. Satellite imagery indicating improving organization in the central convection and good upper-level outflow associated with the tropical disturbance that was to become Nina (191457Z November DMSP visual imagery).

This acceleration along the working best track would greatly affect the forecast movement. For example, if a cyclone is moving at 2 kt (4 km/hr) faster than forecast, it will travel in 72-hours an additional 144 nm (267 km).)

Nina continued to intensify and accelerate. By the time of the second warning at 191800Z, Nina was upgraded to tropical storm intensity. More rapid westward movement was supported by upper-level data at Guam (WMO 91217), Truk (WMO 91334) and Pohnpei (WMO 91348), which indicated 30 kt (15 m/sec) easterly mid-level flow during this time (Figure 3-22-4). At 201600Z, Nina passed 40 nm (74 km) south of Moen Island in the Truk Atoll while moving west-northwestward at 18 kt (33 km/hr). Satellite intensity analysis estimated winds between 45 and 50 kt (23 to 26 m/sec). Maximum winds reported at Moen Island were 60 kt (31 m/sec) with gusts up to 80 kt (41 m/sec). (Note: The difference in intensity may be due to the fact that winds in the right front quadrant of a tropical cyclone are a combination of its kinetic energy and the vector addition of its forward movement.) The lowest pressure recorded was 987 mb, which correlates (Atkinson and Holliday, (1977)) to 50 kt (26 m/sec).

Nina passed the Truk Atoll during the early morning hours on the 21st of November. Civil Action Teams reported that five people were killed, 38 seriously injured, and most of the more than 40,000 residents were homeless and without electrical power. The Truk Atoll was declared a federal disaster area in order to compensate for the $30 to $40 million in damage to housing, businesses and agriculture. In addition, U. S. Armed Forces airlifted supplies into the ravaged islands.

After Nina passed the Truk Atoll, it slowly decelerated. The rate of intensification also slowed. Nevertheless, Nina was upgraded to typhoon intensity at 211200Z. Nina passed

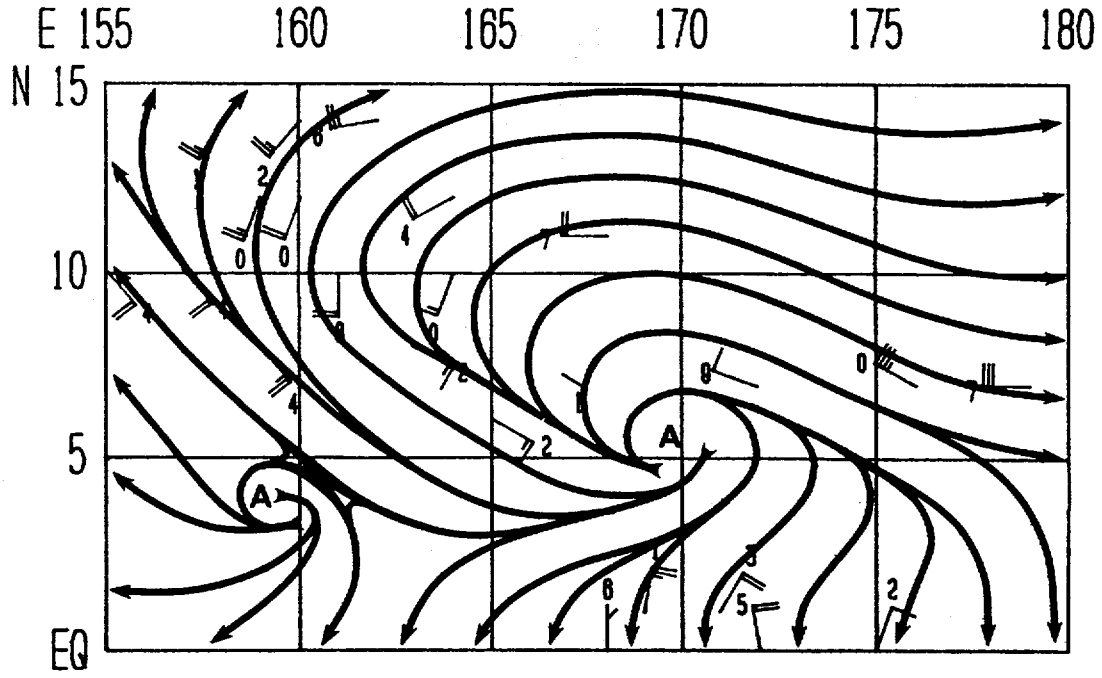

Figure 3-22-3. Synoptic data at 191200Z, showing the center of the upper-level anticyclonic circulation at 200 mb located considerably east of the center of the cirrus outflow associated with Trovical Devression 22W.

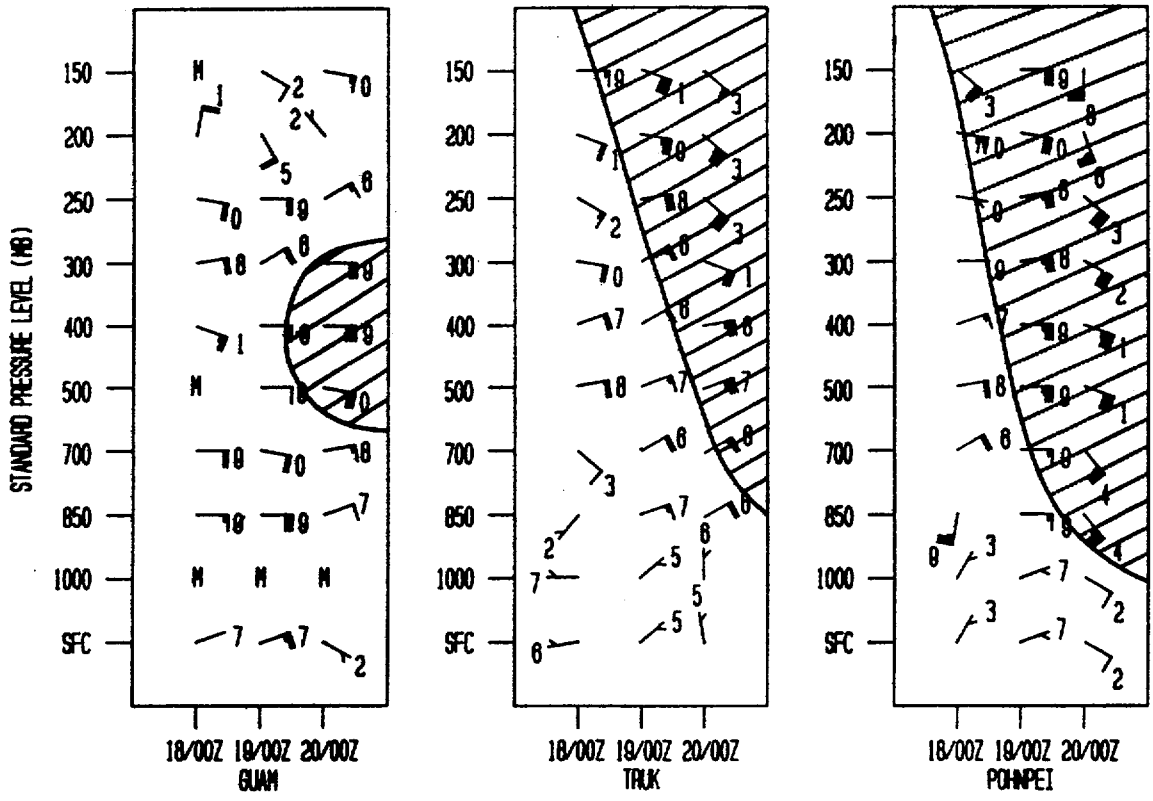

Figure 3-22-4. Upper-air winds and heights at standard pressure levels for Guam (WMO 91217), Truk (WMO 91334) and Pohnpei (WMO 91348) for the period 180000Z to 200000Z. Notice the 30 kt (15 m/sec) mid-level easterlies which would support the rapid movement of Nina toward the west.

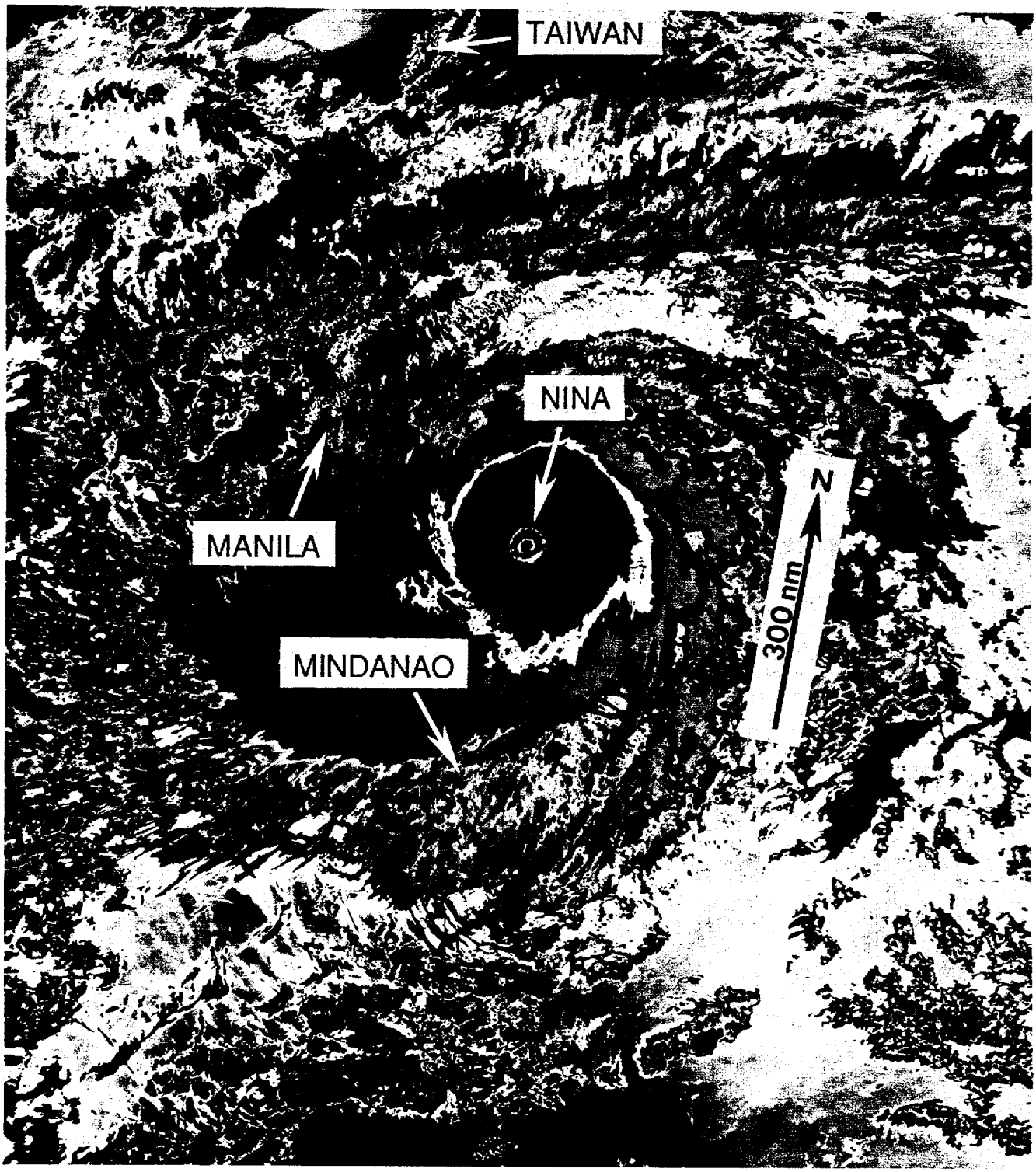

Figure 3-22-5. Satellite imagery showing the well-defined eye of Super Typhoon Nina as it approached the Philippine Islands (250701Z November NOAA visual imagery).

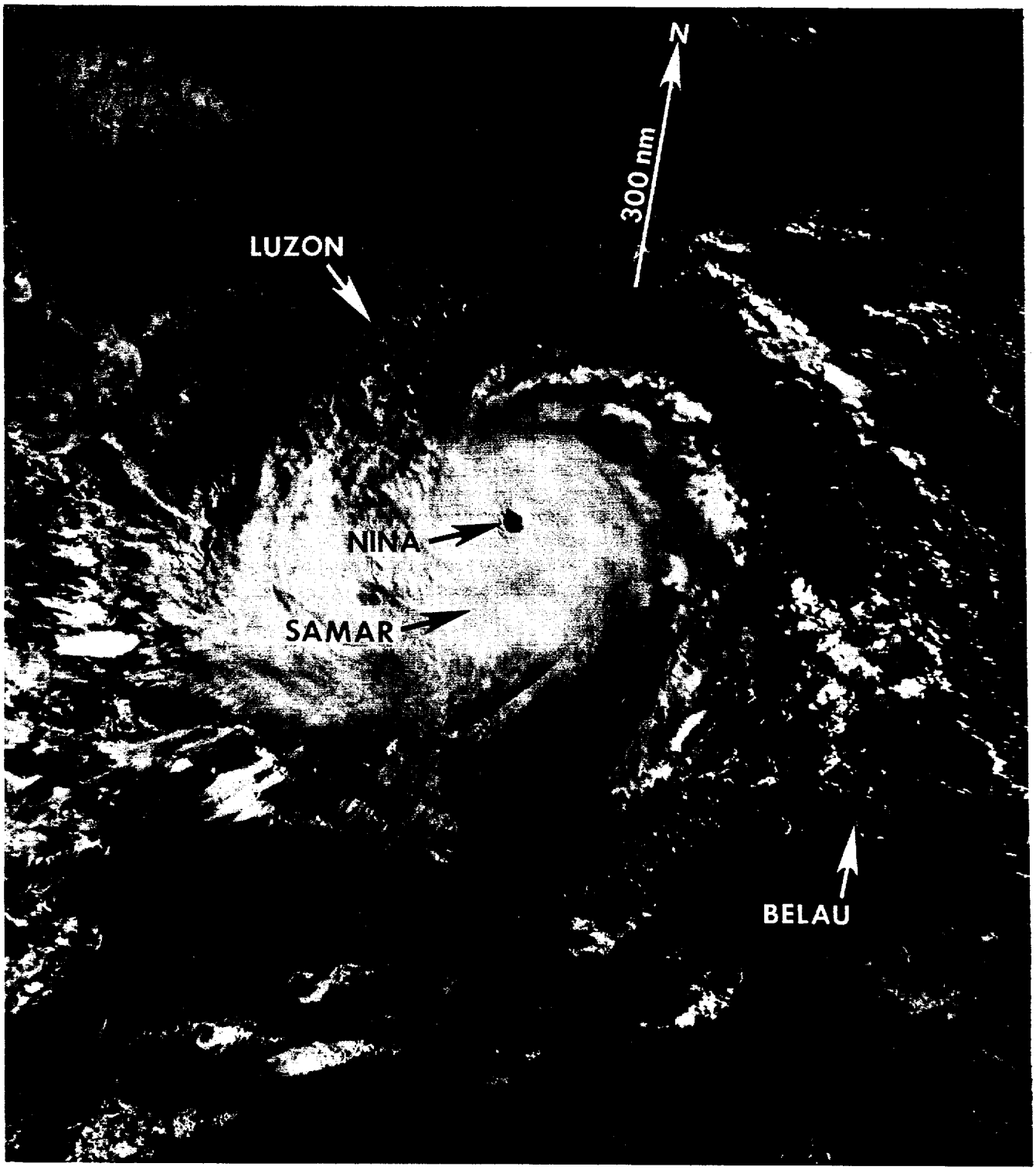

Figure 3-22-6. Matching infrared image for visual in Figure 3-22-5 (250701Z November NOAA infrared imagery).

Prognostic Reasoning

DTG	Direction	Guidance	Speed
260000Z	WNW for 36-hrs then NW	OTCM & COSMOS	Decelerating
261200Z	WNW 12- to 18-hrs then NW	Break in 400 mb ridges	-----
Alternate scenario:	Recurve in 48- to 72-hrs	OTCM	-----
2nd alternate scenario:	Move west	CSUM	-----
270000Z	WNW for 48-hrs	NE surge interaction, ECMWF & NORAPS & HPAC	Slowly decelerating
Alternate scenario:	West	---------	------
271200Z	NW then West	NE surge, NORAPS & NOGAPS & ECMWF	------
280000Z	North for 27-hrs then West	NE surge, 700 & 400 mb progs & HPAC	------
281200Z	ENE	Strong mid- to upper-level westerly flow & CSUM	Accelerating
290000Z	ENE	Strong mid- to upper-level southwesterly flow	Accelerating

Figure 3-22-7. Abbreviated Prognostic Reasoning for the 260000Z through 290000Z November time period.

60 nm (111 km) north of the island of Ulithi and 95 nm (176 km) north of Yap at 221000Z and 221600Z, respectively. Later, on November 25th, an overflying Navy aircraft observed moderate flood damage to the Ulithi's agricultural areas. Twenty percent of the buildings had received structural damage. No damage was reported on Yap.

Nina began to slowly accelerate and rapidly intensify (Holliday and Thompson, 1979), dropping approximately 4 mb per six hours, as it approached the Philippine Islands. Beginning at 241200Z, Nina began to explosively deepen (Holliday and Thompson), dropping approximately 8 mb per six hours. Nina displayed a symmetrical eye that was 18 nm (33 km) in diameter (Figures 3-22-5 and 3-22-6). Nina slammed into the southern tip of Luzon at 251500Z with maximum winds estimated at 145 kt (75 m/sec) with gusts to 175

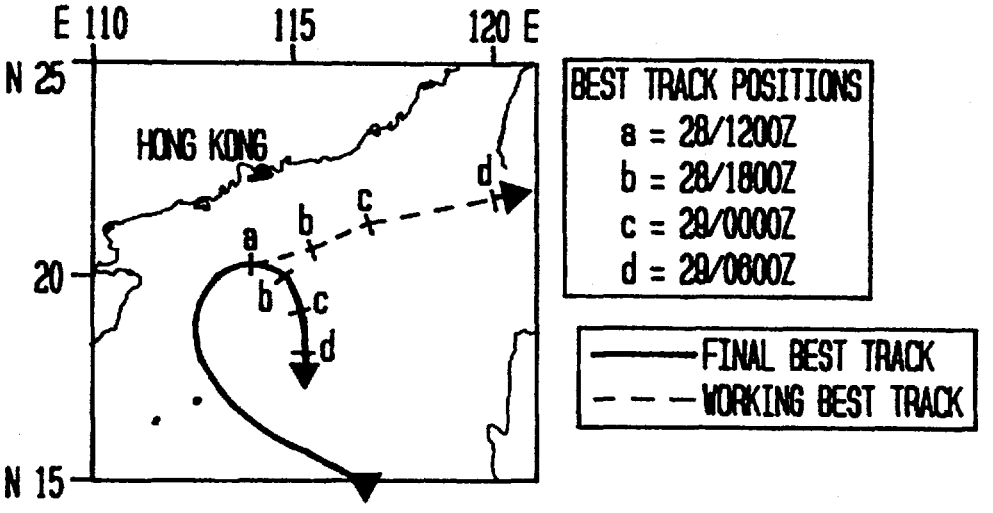

Figure 3-22-8. Difference between the working and final best tracks as Nina was sheared apart by the strong surge of the Northeast Monsoon.

kt (90 m/sec). At least 687 people perished in the north central Philippine Islands. As with the Truk Atoll, Nina struck at night. Philippine authorities declared a state of emergency for 18 provinces that were battered by Nina. Overall more than 500,000 people were either rendered homeless, evacuated, or lost their sources of income. Croplands were heavily damaged. News sources reported that Nina was the most destructive typhoon to hit the Philippine Islands in nearly 20 years.

Nina traversed between the islands of Luzon and Mindoro and entered the South China Sea with 95 kt (49 m/sec) winds. Although satellite imagery could not detect an eye, land-based radar continued to track the cloud covered eye. Shortly thereafter, Nina was packing 100 kt (51 m/sec) winds.

Once Nina was in the South China Sea, the forecast philosophy attempted to keep up with the changing synoptic situation. Figure 3-22-7 provides an abbreviated look at the specifics of each prognostic reasoning message for the 260000Z through 290000Z November time period. Basically what initially appeared to be straight-forward, wasn't! The decoupling of Nina's lower- and upper-level circulations developed into a complex event; culminating in the 270000Z prognostic reasoning message, which became a classic example of being wrong for all the right reasons. The net result was a very tense situation for Hong Kong and the southern China coast.

As the system began to move northward, an eye became visible at 280300Z. Within 6- to 12-hours, Nina was sheared apart by the shallow, but strong, low-level surge in the northeast monsoon flow and strong westerly winds at the mid- and upper-levels. During the shearing, the deep convection, which was poorly defined and being positioned as an upper-level circulation by satellite, accelerated east-northeastward along the quasi-stationary front. As a consequence, the forecast philosophy embraced a cloud system moving rapidly through the Luzon Strait and becoming extratropical. (Post-analysis found that the low-level most probably separated from the upper-level circulation center at 280600Z. This resulted in a 340 nm (630 km) difference at 24-hours between the working best track and the final best track points as seen in Figure 3-22-8.) The upper-level cloudiness did move east-northeastward; however, the low-level circulation center executed an anticyclonic loop and headed slowly southward with the monsoonal flow. The residual low-level vorticity and cloudiness rapidly dissipated over the South China Sea.